REMARKS

Claims 1-12, 14, and 16-17 are pending. Claims 1, 4, and 16 have been amended for editorial purposes without narrowing the scopes of the claims. The amendment to claim 4 is supported at least by the specification in page 20, lines 8-28. The amendment to claim 16 is supported at least by the specification in page 13, lines 20-25. Applicants respectfully submit that no new matter has been introduced.

Double Patenting

Claims 1-12 and 14 were rejected on the ground of double patenting over claim 1 of US 7,754,844 in view of McGrath (US 2006/0258836). Applicants respectfully traverse the rejections.

Present claim 1 recites an **electrolyte membrane-electrode assembly** comprising a pair of electrodes and a hydrocarbon-based solid polymer electrolyte membrane. Claim 1 of US 7,754,844 recites a **polyarylene ether-based compound** comprising polymer components having general formula (1) and general formula (2). The **polyarylene ether-based compound** of US 7,754,844 is only one of the starting materials for making the **electrolyte membrane-electrode assembly** recited in present claim 1. Because the product according to present claim 1 is different from the product according to claim 1 of US 7,754,844, the claims do not conflict and there should be no double patenting. Indeed, **an electrolyte membrane-electrode assembly**, as recited in present claim 1, is an invention that is of a different category from a **polyarylene ether-based compound**, as recited in claim 1 of US 7,754,844. Therefore, present claim 1 should not be rejected on the ground of double patenting over claim 1 of US 7,754,844 in view of McGrath.

In addition, US 7,754,844 in view of McGrath does not teach or suggest an electrolyte membrane-electrode assembly wherein the maximum water content (Wm) of the electrolyte membrane is within the range of from 10% to 45% or 70 to 120%, as recited in present claim 1.

Prior to the present invention, it was difficult to produce a durable and

reliable electrolyte membrane-electrode assembly wherein the maximum water content (Wm) of the electrolyte membrane is within the range of from 10% to 45% or 70 to 120% due to problems such as the difficulty or impossibility in forming a durable joint between the electrolyte membrane with a maximum water content within the specified range and the electrodes by conventional hot pressing, and possible degradation, embrittlement, and/or deformation of the electrolyte membrane. *See* specification, page 12, line 19 to page 13, line 15. Despite the above-described difficulty, applicants managed to develop the claimed electrolyte membrane-electrode assembly wherein the electrolyte membrane has a maximum water content within the range of from 10% to 45% or 70 to 120% and is joint with the electrodes. The claimed electrolyte membrane-electrode assembly exhibits high reliability and durability with improved joints between the electrodes and the electrolyte membrane. *See* specification, page 14, lines 5-9.

On the other hand, claim 1 of US 7,754,844 merely recites a **polyarylene ether-based compound** but fails to teach or suggest an electrolyte membrane-electrode assembly wherein the electrolyte membrane has a maximum water content within the range of from 10% to 45% or 70 to 120%, as recited in present claim 1. The deficiency of US 7,754,844 is not cured by McGrath at least because McGrath does not teach or suggest an electrolyte membrane-electrode assembly wherein the electrolyte membrane has the maximum water content as recited in present claim 1.

For at least these reasons, withdrawal of the double-patenting rejections is respectfully requested.

Claim Rejections under 35 U.S.C. §112

I. Claims 1-12 and 14 were rejected as being indefinite under 35 U.S.C. § 112, second paragraph on the ground that it was unclear how the water content of a material could be within the range of 10%-45% or 70%-120% without being capable of existing between 45%-70%. Applicants respectfully traverse the rejections.

In view of the specification, it would be clear to a person of ordinary skill in the art that the maximum water content of the electrolyte membrane may be controlled by adjusting the amount of the acidic functional groups such as the sulfonic acid groups in the electrolyte membrane. For example, the specification teaches that water retention of the electrolyte membrane results from the existence of the acidic functional groups in the membrane. *See* page 11, lines 21-22 ("because in such an electrolyte membrane water is held by acidic functional groups, the electrolyte membrane shows water retentivity.") In addition, the specification teaches at page 20, lines 9-11, that hygroscopicity increases with the increase of the amount of the sulfonic acid groups contained in the electrolyte membrane ("when the amount of sulfonic acid groups introduced is increased in order to increase the ion conductivity, the hygroscopicity also increases ..."). Based on these disclosures, a person of ordinary skill in the art would understand that the maximum water content of the electrolyte membrane, which is a parameter reflecting the hygroscopicity, can be controlled within the specified range, *i.e.*, from 10% to 45% or 70 to 120%, by increasing or decreasing the content of the acidic functional groups such as the sulfonic acid groups in the electrolyte membrane. Applicants respectfully traverse the Office Action's requirement that applicants "must select one of the two ranges or the whole range of 10%-120%. The ranges fail to further limit each other." According to MPEP 2173.05(h), "[a]lternative expressions are permitted if they present no uncertainty or ambiguity with respect to the question of scope or clarity of the claims." Here, the alternative ranges of "10% to 45%" and "70% to 120%" would not present any uncertainty or ambiguity. Claim 4 should be permitted to recite the alternative ranges. Because they are alternative ranges, they are not required to further limit each other. Therefore, claims 1-12 and 14 are in compliance with the requirements of 35 U.S.C. §112, second paragraph. Withdrawal of the indefiniteness rejections is respectfully requested.

II. Claim 4 was rejected as being indefinite on the grounds that lambda is not clearly defined in the claim and that the relationship between the acid group and humidity is indefinite. Applicants respectfully traverse the rejection.

Without conceding to the propriety of this rejection and in order to expedite prosecution, applicants have amended claim 4.

It would be clear to a person of ordinary skill in the art that claim 4 defines the term "moisture absorption (λ)" as "the number of water molecules per sulfonic acid group under an atmosphere at 80°C and 95% relative humidity." In addition, claim 4 does not recite a relationship between the acid group and humidity. Rather, claim 4 recites "a moisture absorption (λ) ... of a value less than Y, wherein Y = (sulfonic acid group content) x 6 – 2." Furthermore, claim 4 would be clear to a person of ordinary skill in the art in view of the disclosures at page 20, lines 8-28 of the specification regarding the definition of the term "moisture absorption (λ)" and the desirability to control λ to be a value less than (sulfonic acid group content) x 6 – 2 in order to obtain an electrolyte membrane with good membrane dimension stability in wetting. The Office Action rejects claim 4 in part because it took the position that "relation (sulfonic acid group content) x 6 – 2" does not positively recite structure claim limitations. Applicants note that the claim limitation refers to the value of the moisture absorption (λ) and is tied in with the sulfonic acid content. Thus, the objected to claim limitation is based on a structural claim limitation. For at least these reasons, claim 4, as amended, is in compliance with the requirements of 35 U.S.C. §112, second paragraph. Withdrawal of the rejection is respectfully requested.

Claim Rejections under 35 U.S.C. §102

Applicants respectfully traverse the rejections of claims 1, 3-12, and 14 as allegedly being anticipated by McGrath under 35 U.S.C. §102(e).

Claims 1, 3-12, and 14 are not anticipated by McGrath at least because McGrath does not teach an electrolyte membrane-electrode assembly, as recited in claim 1. McGrath teaches ion-conducting, nitrile containing

sulfonated polymeric materials. *See, e.g.*, abstract. Although McGrath mentions in the abstract that these nitrile containing sulfonated polymers may be used to form membranes that have an application in a fuel cell, McGrath does not teach an electrolyte membrane-electrode assembly at all, let alone an electrolyte membrane-electrode assembly comprising a pair of electrodes and a hydrocarbon-based solid polymer electrolyte membrane, which electrolyte membrane is sandwiched between and joined with the electrodes, as recited in claim 1. Furthermore, McGrath does not teach an electrolyte membrane-electrode assembly wherein the maximum water content of the electrolyte membrane is within the specified range (from 10% to 45% or 70 to 120%), as recited in claim 1.

Because McGrath does not disclose each and every limitation of claim 1, claims 1, 3-12, and 14 are not anticipated by McGrath.

Claim Rejections under 35 U.S.C. §103

I. Applicants respectfully traverse the rejections of claims 3-12 under 35 U.S.C. §102(e) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over McGrath.

Claims 3-12 are not anticipated by or rendered obvious over McGrath at least because McGrath fails to teach or suggest **an electrolyte membrane-electrode assembly**, comprising a pair of electrodes and a hydrocarbon-based solid polymer electrolyte membrane, which electrolyte membrane is sandwiched between and joined with the electrodes, as recited in claim 1 (from which claims 3-12 depend). Furthermore, McGrath fails to teach or suggest an electrolyte membrane-electrode assembly wherein the maximum water content of the electrolyte membrane is within the range of from 10% to 45% or 70 to 120%, as recited in claim 1.

Applicants have found, surprisingly, that an electrolyte membrane-electrode assembly using a hydrocarbon-based solid polymer electrolyte membrane with a maximum water content within the range of from 10% to 45% or 70 to 120% had improved joints, higher reliability, and superior durability.

Prior to the present invention, it was difficult or impossible to provide a durable and reliable electrolyte membrane-electrode assembly where the maximum water content of the electrolyte membrane was within the range of from 10% to 45% or 70 to 120% by conventional hot pressing. *See* specification, page 12, line 19 to page 13, line 15. For example, an electrolyte membrane with the maximum water content within the range of 70 to 120% could not be joined with an electrode by hot pressing due to the high level of water retention. *Id.* Although an electrolyte membrane with the maximum water content within the range of from 10% to 45% might be forced to join with an electrode at higher temperatures, degradation and embrittlememt of the electrolyte membrane would occur, leading to reduced durability. *Id.* On the other hand, the claimed invention provides an electrolyte membrane-electrode assembly, wherein the electrolyte membrane with a maximum water content of from 10% to 45% or 70 to 120% is joined with the electrodes, with unexpectedly superior reliability and durability.

For at least these reasons, claims 3-12 are not anticipated by or rendered obvious over McGrath. Withdrawal of the rejections is respectfully requested.

II. Applicants respectfully traverse the obviousness rejection of claim 2 over McGrath as applies to claim 1 and further in view of Barton et al. (US 6,057,054).

As discussed above, McGrath does not teach or suggest an electrolyte membrane-electrode assembly at all, let alone an electrolyte membrane-electrode assembly comprising a pair of electrodes and a hydrocarbon-based solid polymer electrolyte membrane with the specified maximum water content, which electrolyte membrane is sandwiched between and joined with the electrodes, as recited in claim 1. The deficiencies of McGrath are not cured by Barton because Barton fails to teach or suggest an electrolyte membrane-electrode assembly comprising a hydrocarbon-based solid polymer electrolyte membrane with the specified maximum water content, as recited in claim 1.

Therefore, claim 2 would not have been obvious over McGrath in view of Barton. Withdrawal of the rejection is respectfully requested.

CONCLUSION

The Examiner is encouraged to contact the undersigned regarding any questions concerning this amendment. In the event that the filing of this paper is deemed not timely, applicants petition for an appropriate extension of time. The Commissioner is authorized to debit Deposit Account No. 11-0600 the petition fee and any other fees that may be required in relation to this paper.

Respectfully submitted,
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